

Quarterly Progress Report  
Contract: NASW-99004  
Period: 4 June 2001 - 4 September 2001  
Principal Investigator: Daniel R. Weimer

Title of Investigation: "Obtaining reliable predictions of Terrestrial energy coupling from real-time solar wind measurements"

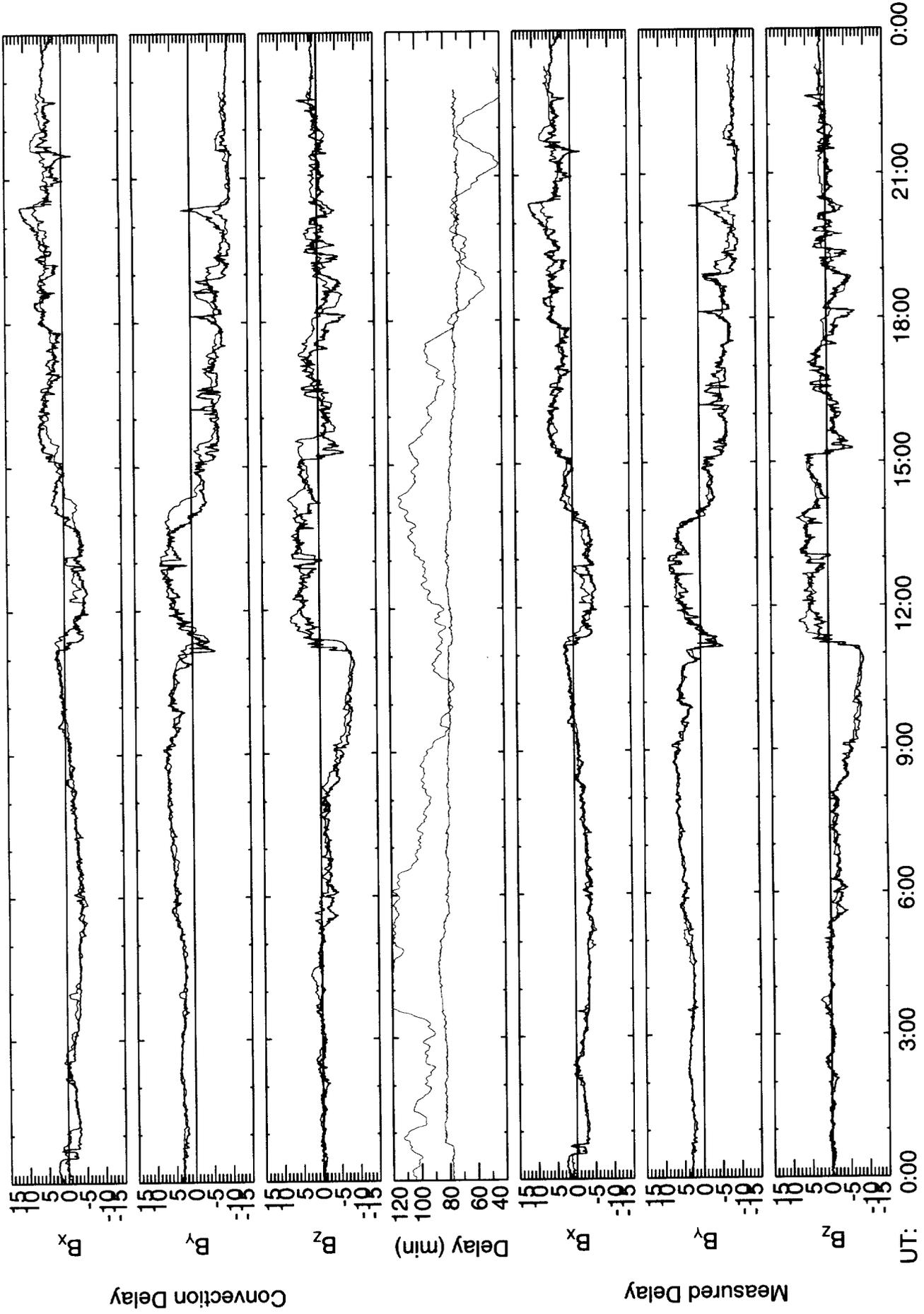
This project has the objective of using measurements from 3 or 4 satellites in the "upstream" solar wind to determine how the temporal and spatial scales affect the ability to make reliable predictions of the Earth's "space weather" from measurements at the L1 orbit, and to develop techniques to improve the timing of the predictions.

Work in this quarter was concentrated on preparing a manuscript for submission to the *Journal of Geophysical Research*. A first draft of the manuscript has been completed at this time and circulated to co-authors (ISTP Principal Investigators) for comments prior to submission. This paper is about the "Variable time delays in the propagation of the interplanetary magnetic field." Prior to the preparation of this manuscript it was necessary to update all of the data access and analysis routines in order to use the highest resolution data available, rather than the preliminary "Key Parameter" values. The IMF measurements with a time resolution of 16 seconds or better are now used from all four satellites (ACE, Wind, IMP-8, and Geotail). The computer program that calculates the IMF propagation time delays between satellites has also undergone another revision in order to improve speed and accuracy.

The most significant development during this quarter has been the development of a method for calculating the orientation of IMF phase fronts from a single-satellite measurement. As we have demonstrated earlier in this project, the phase front angle needs to be known in order to make accurate predictions of the timing of "space weather" predictions based on real-time upstream measurements at L1. The two attached figures show an example case. The first figure shows IMF measurements from both ACE and Wind taken on March 12, 2001. The upper three plots show the ACE measurements in black and the Wind measurements in green. The Wind data have been shifted in time according to the instantaneous value of the "convection delay," the value which is shown in the green line in the middle plot. The bottom three panels again show the ACE IMF measurements in black, and now the Wind data, in blue, have been shifted in time by the "measured delay," also shown in the middle plot. In this case the measured delay is that which produces the best agreement between ACE and Wind.

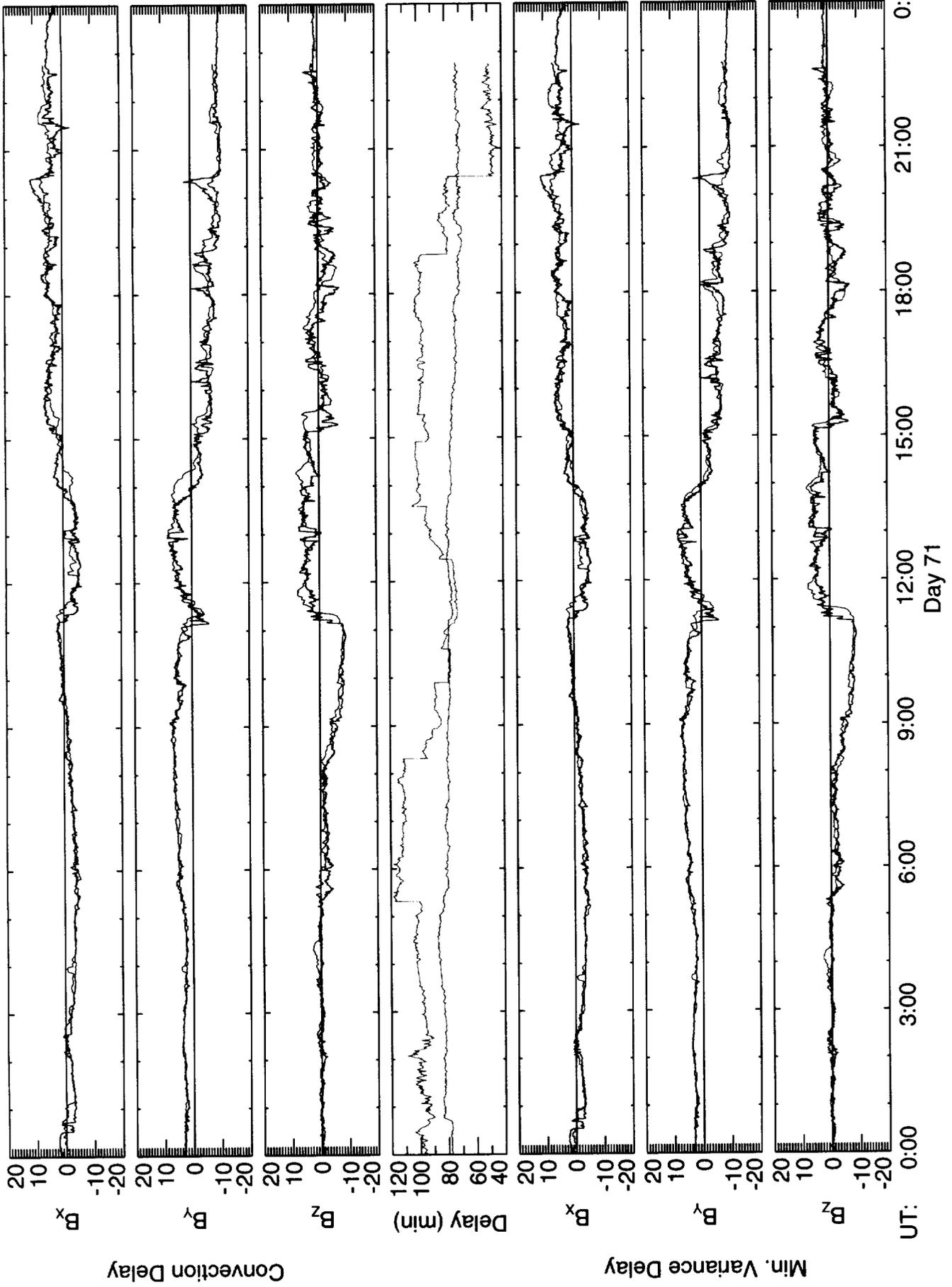
The method for calculating the orientation of the phase fronts is based on the "minimum variance" technique. Results for this same case are shown in the second figure, where now the blue lines represent the delay time and delayed IMF resulting from a minimum variance phase plane tilt. The agreement between the predicted and measured delays is quite good. This technique is still in the experimental state, and the success is sensitive to variations in the parameters used for the calculations. For this particular case, 113 data points (at 16 second intervals) are used for the minimum variance calculations, and "matrix eigenvalue ratios" less than 15. were rejected, as well as any results having angles greater than 75 degrees. Work in the next quarter will concentrate on optimizing the minimum variance technique, as well as completing and submitting the JGR manuscript.

# IMF LAG FROM ACE TO WIND ON 2001/03/12



# IMF LAG FROM ACE TO WIND ON 2001/03/12

MV pts.= 113 EV Ratio=15.0 Max. Angle=75.0 Vyz=1



TR/IN/90

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13. ABSTRACT (Maximum 200 words) The first draft of a manuscript titled "Variable time delays in the propagation of the interplanetary magnetic field" has been completed, for submission to the <i>Journal of Geophysical Research</i> . In the preparation of this manuscript all data and analysis programs had been updated to the highest temporal resolution possible, at 16 seconds or better. The program which computes the "measured" IMF propagation time delays from these data has also undergone another improvement. In another significant development, a technique has been developed in order to predict IMF phase plane orientations, and the resulting time delays, using only measurements from a single satellite at L1. The "minimum variance" method is used for this computation. Further work will be done on optimizing the choice of several parameters for the minimum variance calculation.				
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